



Geographic Access to Registered Behavior Technicians among Children with Autism Spectrum Disorder

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Accepted: 22 June 2022 / Published online: 7 July 2022
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Abstract

Research has documented inequities in geographic access to board certified behavior analysts (BCBAs) among children with autism spectrum disorder (ASD). Unexplored is geographic access to registered behavior technicians (RBTs), the frontline ABA providers BCBAs supervise. In this study we examined county-level geographic access to RBTs in the United States, including change in their geographic distribution over time, the current distribution of RBTs related to the distribution of BCBAs, and the current distribution of RBTs as a function of children with ASD. The sample included all U.S. counties in all 50 states and the District of Columbia ($N = 3,138$). County-level ASD/RBT ratios indicate that the number of children with ASD far exceed RBTs, and the geographic accessibility of RBTs appears to be superior to that of BCBAs.

Keywords Autism spectrum disorder · Geographic access · Registered behavior technicians · Board certified behavior analysts · Applied behavior analysis

Applied behavior analysis (ABA) is the scientific study of behavior change, using the principles of behavior, to evoke or elicit targeted behavioral change (Furman & Lepper, 2018). Numerous outcome studies since the late 1980s have shown the potential of interventions based on the principles of behavior to alter the developmental trajectory of children with autism spectrum disorder (ASD; Cohen et al., 2006; Eikeseth et al., 2002, 2007, 2009; Eldevik et al., 2006; Howard et al., 2005; Lovaas, 1987; Remington et al., 2007; Smith & Iadarola, 2015). Since then, the demand for ABA services among this population has steadily increased (Behavior Analyst Certification Board, n.d.-b). In 1998, dedicated professionals established the Behavior Analyst Certification Board (BACB), a nonprofit credentialing body with a mission to protect consumers of ABA services by promoting and disseminating professional standards of practice (BACD, n.d.-a).

The BACB offers two professional credentials, one special designation,¹ and one paraprofessional credential for ABA providers. According to the BACB, professionals holding a board certified behavior analyst (BCBA) master's-level credential have met minimal competency standards to independently practice ABA. Whereas professionals holding a board certified assistant behavior analyst (BCaBA)² bachelor's-level credential have met minimal competency standards to practice ABA while under the supervision of a qualified supervisor.³ Finally, paraprofessionals holding a registered behavior technician (RBT) credential have met minimal competency standards to deliver behavior analysis services under the direction and close supervision of a qualified supervisor.

Over the last 20 years, the number of BACB certified professionals has grown considerably (Carr & Nosik, 2017). There are now over 50,000 BCBA and BCBA-D certificants

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¹ The board certified behavior analyst-doctoral (BCBA-D) credential is available for doctoral-level BCBAs who meet additional eligibility criteria (BACB, 2022b).

² The BCaBA credential was originally referred to as the board certified associate behavior analyst (BACB, n.d.-a) credential but was updated in 2009 (BACB, 2007).

³ BCaBAs must be supervised by an active BCBA in good standing, or a licensed or registered psychologist certified by the American Board of Professional Psychology who tested in ABA (BACB, 2022a).

qualified to independently practice, with only a third having this credential for 3 years or less, and over half having their credential for 5 years or less (BACB, *n.d.-b*). Even with this growth, the demand for well-trained and qualified BCBAs to implement behavioral services continues to far outpace the supply (BACB, 2021).

The same has been true for frontline practitioners directly implementing ABA protocols with clients. In response to the high demand for these professionals, in 2014, the BACB created the RBT credential to ensure a baseline level of training and oversight for front-line staff implementing protocols directly with sensitive client populations (BACB, 2013; Carr et al., 2017). To qualify as an RBT, a paraprofessional must be 18 years old, have earned a high school diploma, pass a background check, complete a 40-hr training, and submit to a competency assessment (BACB, 2022c). RBTs are not permitted to practice independently and are directed and closely supervised by qualified RBT supervisors or RBT requirements coordinators. RBT supervisors must hold a BACB professional credential or be licensed in another behavioral health profession with ABA in its legislative scope. RBTs may also be supervised by one RBT requirements coordinator holding a BCBA credential who is typically responsible for overseeing the supervision of multiple RBTs. Each calendar month, RBTs must receive supervision at a minimum of 5% of the hours spent delivering ABA services (BACB, 2022c). The credential offers a structure for training and supervision, and more funders are requiring the credential as a standard. RBTs primarily work with children with ASD and may provide in-home or clinic-based services under the direction of a BCBA. Although their caseload varies, they typically provide the bulk of direct treatment hours for clients receiving focused or comprehensive ABA services (Council of Autism Service Providers, 2020). The RBT credential has value because it signals to stakeholder groups (providers, business owners, consumers, and third-party funders) that front-line staff have demonstrated minimal competence as determined by a recognized,⁴ independent, nonprofit credentialing body to practice ABA under the close direction and supervision of qualified professionals.

Since the certification's inception, the number of RBTs has increased from 328 in 2014 to more than 100,000 in 2021 (BACB, *n.d.-b*). Yet the accessibility of these providers in the United States remains unclear.⁵ Although insurance mandates have reduced financial barriers for many children

enrolled in health insurance plans that are subject to mandates, evidence indicates significant remaining unmet needs. West Virginia passed its mandate in 2012, yet long wait lists due to provider shortages persist (Lofton, 2016). The same challenges are reported in North Carolina (Ovaska-Few, 2018), Nevada (Bekker, 2018), and New York (Bump, 2017). A handful of recent studies have examined the geographic accessibility of BCBAs. Results demonstrate inequities in their accessibility at the state and county levels. For instance, the number of BCBAs in a state have been associated with state health-care insurance mandates (McBain et al., 2020) and the state per capita supply of BCBAs fall below caseload guidelines provided by the BACB (Zhang & Cummings, 2020). More than half of all counties in the United States have no BCBAs, the county-level prevalence of ASD does not necessarily drive BCBA supply, and affluent and urban counties have the highest geographic accessibility (Yingling, Ruther, Dubuque, & Bell, 2021a; Yingling, Ruther, Dubuque, & Mandell, 2021b). To date, however, the authors are not aware of similar research on RBTs. Therefore, the purpose of this study was to examine the county-level geographic access of RBTs in the United States, including change in their geographic distribution over time, the current distribution of RBTs related to the distribution of BCBAs, and the current distribution of RBTs as a function of children with ASD.

Method

Data and Sample

We used a publicly available anonymized list of 222,106 providers (171,441 RBTs and 50,665 BCBAs) certified in the United States on or before December 31, 2021. For the purposes of this study, the BCBA-D designation was included with the BCBA certifications, and the BCaBA certification was excluded because these mid-level providers represent less than 10% of the BACB certificants in the United States (over 40% in Florida) and must be supervised by a BCBA or BCBA-D (BACB, *n.d.-b*). The provider list included the location ZIP code of each provider, as well as their certification status. All records with a certification status of "Inactive" or "Revoked" were removed from the sample (4,481 RBTs and 228 BCBAs). This study received approval from the University of Louisville Institutional Review Board.

Providers were assigned to their county of practice based on their location ZIP code. In those cases where a ZIP code crossed a county boundary, providers within that ZIP code were assigned to each county based on the percent of overlap of business addresses between the ZIP code and the county using the HUD ZIP-County Crosswalk (Wilson, 2018). The number of RBTs and BCBAs certified in each year of the

⁴ The BACB's RBT credentialing program is accredited by the National Commission on Certifying Agencies (NCAA), the accrediting body of the Institute of Credentialing Excellence (ICE).

⁵ The number of RBTs recommended per client with ASD is highly individualized and based on a variety of variables such as treatment dosage, severity of diagnosis, presenting maladaptive behaviors, intervention selected, and generalization of skills.

past 7 years (2015–2021) was then aggregated within each county ($N = 3,138$), as were the cumulative numbers of RBTs and BCBAAs in each year (2015–2021). To examine trends in certification, we aggregated by certification year (2016–2021); we excluded 2015 because the relatively low number of certifications in that year led to a map indistinguishable from the 2016 map. Of the 166,960 RBT providers, 1,292 (0.8%) had ZIP codes that did not exist within the U.S. Census Bureau's ZIP code database—likely due to the process through which the Bureau translates a ZIP code (technically, a route) into a contiguous polygon. These providers could not be accurately assigned to a county and were excluded from further analysis. Of the 50,437 active BCBA providers, 115 (0.3%) had ZIP codes that could not be accurately assigned to a county and were excluded from further analysis. The study sample thus included all U.S. counties and county equivalents (e.g., boroughs, parishes, independent cities) in all 50 states and the District of Columbia ($N = 3,138$).

For the county-level RBT counts, we integrated publicly available data on the number of children with ASD from the U.S. Department of Education's Civil Rights Data Collection (CRDC). The CRDC is a biennial census of the students within public schools, used to assess education and civil rights issues. All local educational agencies in the United States (i.e., school districts, charter schools, juvenile justice facilities, alternative schools, and schools serving only students with disabilities) are included in the CRDC tabulations (U.S. Department of Education, 2018). The most recently available CRDC data covers 2017–2018.

The CRDC includes the total enrollment and number of children with educational disabilities by district, with the latter number aggregated within the primary special education category of the child. In this study, we included children with a primary special education category of ASD (note that these categories do not represent medical diagnoses and that it is possible for a child to have been assigned a special education category of ASD but no medical diagnosis). Children with a different primary special education category (and a secondary diagnosis of ASD) were not included in this analysis.

The counts of children with ASD and total school enrollments were allocated to counties based on the location of the school district. In many cases, a school district lies within a single county. In cases where a single district spans multiple counties, the CRDC counts were assigned to the different counties based on the percentage of the district population that was within each county from the Missouri State Data Center's geographic correspondence files (Saporito et al., 2007).

Variables

We examined geographic access to RBTs in several ways. First, we categorized *RBT presence* as (1) the presence of at least one RBT in a county; (2) no RBTs in a county; or (3) no RBTs in a county and no RBTs in a bordering county. We then examined change in geographic access through the production of six maps that illustrate the cumulative number of RBT certifications over the years 2016 through 2021.

Next, we examined the distribution of RBTs in relation to BCBAAs as of December 31, 2021. We categorized *RBT and BCBA presence* as (1) No BCBAAs, at least one RBT; (2) No RBTs, at least one BCBA; (3) At least one BCBA and one RBT; or (4) No RBTs, no BCBAAs. For each county, we then calculated the *ASD/RBT ratio* as the quotient of the number of children with ASD divided by the number of RBTs.

Furthermore, there were 101,150 active RBTs in the U.S., and of those RBTs, 19.2% (19,456) did not have an assigned RBT supervisor or RBT coordinator. These nonpracticing RBTs may have been between jobs, may have left the workforce, or were not practicing for some other unknown reason. Whether RBTs are theoretically active versus currently providing services has implications for geographic accessibility. Therefore, we ran cross-sectional analyses that excluded nonpracticing RBTs and compared the results with analyses that included all active RBTs (including nonpracticing RBTs).

Results

Table 1 includes the descriptive statistics of outcome variables. As of July 2021, slightly more than two-thirds of all counties had at least one RBT. Among the remaining counties, 91 (3%) had no RBT and bordered only counties with no RBTs. Excluding Iowa, these counties included 559 kids with ASD. However, when only practicing RBTs—those currently with a supervisor or coordinator—are counted, 173 (6%) of counties had no practicing RBT and bordered only counties with no practicing RBT. These counties included 2,146 children with ASD. These areas are located primarily in a ribbon through the Plains states, from the Dakotas south to northern Texas. The first RBT certifications were granted in 2014, although there were relatively few providers certified (approximately 11,400) in the first 2 years. Beginning in 2016, the number of providers earning the RBT certification began increasing exponentially. Figure 1 shows the RBT distribution across U.S. counties as a function of population in each year between 2016 and 2021.⁶ RBT presence

⁶ We are unable to replicate this map using only practicing RBTs because we are unable to tell whether a particular RBT had a supervi-

Table 1 Descriptive statistics for prevalence of autism spectrum disorder and distribution of registered behavior technicians in 2021 (*N* = 3,138)

Variable	n	%	Mean	Median	n	%	Mean	Median
<i>ASD Prevalence (per 1,000 Enrolled)</i>								
No ASD Reported	99	3.2	9.3	8.9				
0.0–5.0	397	12.7						
5.1–7.5	653	20.8						
7.6–10.0	810	25.8						
10.1–15.0	911	29.0						
15.1–45.2	268	8.5						
	<i>All RBTs</i>				<i>Practicing RBTs Only</i>			
<i>RBT Presence</i>			52.7	3			28.3	1
RBTs	2245	71.5			1973	62.9		
No RBTs, RBTs in Bordering County	802	25.6			992	31.6		
No RBTs, No RBTs in Bordering Counties	91	2.9			173	5.5		
<i>RBT and BCBA Presence</i>								
No RBT, No BCBA	726	23.1			892	28.4		
No BCBA, at least 1 RBT	623	19.9			457	14.6		
No RBT, at least 1 BCBA	167	5.3			273	8.7		
At least 1 RBT, at least 1 BCBA	1622	51.7			1516	48.3		
<i>ASD/RBT Ratio</i>								
No RBTs	893	28.8	12.7	6.6	1165	37.5	18.9	10.6
0–5.0	870	28.1			383	12.3		
5.1–10.0	565	18.2			558	18.0		
10.1–25.0	498	16.1			628	20.2		
25.1–50.0	188	6.1			226	7.3		
50.1–499.0	83	2.7			143	4.6		

Iowa’s 99 counties did not report CRDC data. These counties were not included in the ASD Prevalence or ASD/RBT Ratio calculations. 41 (35) counties in Iowa have RBTs (practicing RBTs) but did not report CRDC data. Percentages may not sum to 100 due to rounding

in the earlier years was concentrated in the state of Indiana, northern California, and along much of the eastern seaboard. These areas remain hotspots of RBT presence, with notable concentrations in Indiana, Florida, and much of California in 2021. However, there is also evidence of large numbers of RBTs in Utah, Colorado, and Hawaii, as well as in scattered counties throughout the Midwest.

Figure 2a illustrates the co-presence of actively certified RBTs and BCBAs across the United States, and Fig. 2b shows the co-presence of practicing RBTs and BCBAs. These maps demonstrate that approximately half of all counties have at least one RBT (or practicing RBT) and one BCBA and a large number of counties have one provider type (usually an RBT) but not the other. However, 23% of counties—indicated in pink—have neither a BCBA nor an RBT in residence. This dearth of providers is somewhat more conspicuous when focusing only on practicing

RBTs—more than 28% of counties have neither a BCBA nor a practicing RBT. Again, these “no-provider” counties follow a swath from the upper Mountain and Plains states down through Texas. There are also notable concentrations in parts of the Southeast and in the Appalachian region in West Virginia and Kentucky.

Finally, Fig. 3a and b display the ratio of the number of children with ASD from the most recent CRDC data to the count of RBTs or practicing RBTs within each county. These maps include the same legend classes so that they can be easily compared. The counties with the highest ASD/RBT ratios when considering only practicing RBTs are Jackson County (Medford), OR, Penobscot County (Bangor), ME, and Olmsted County (Rochester), MN. In each of these counties—all of which have student enrollments of 20,000 or more—there are more than 330 children with ASD per currently practicing RBT provider. In general, high ASD/RBT ratio clusters are observable in counties in Minnesota and Wisconsin, western New York and Pennsylvania, and in the Pacific Northwest. The large numbers of RBTs in Indiana, Florida, Southern California, and Hawaii result in counties

Footnote 6 (continued)

sor or coordinator within any given year. We are only able to discern whether the RBT is being supervised as of the date of the data.

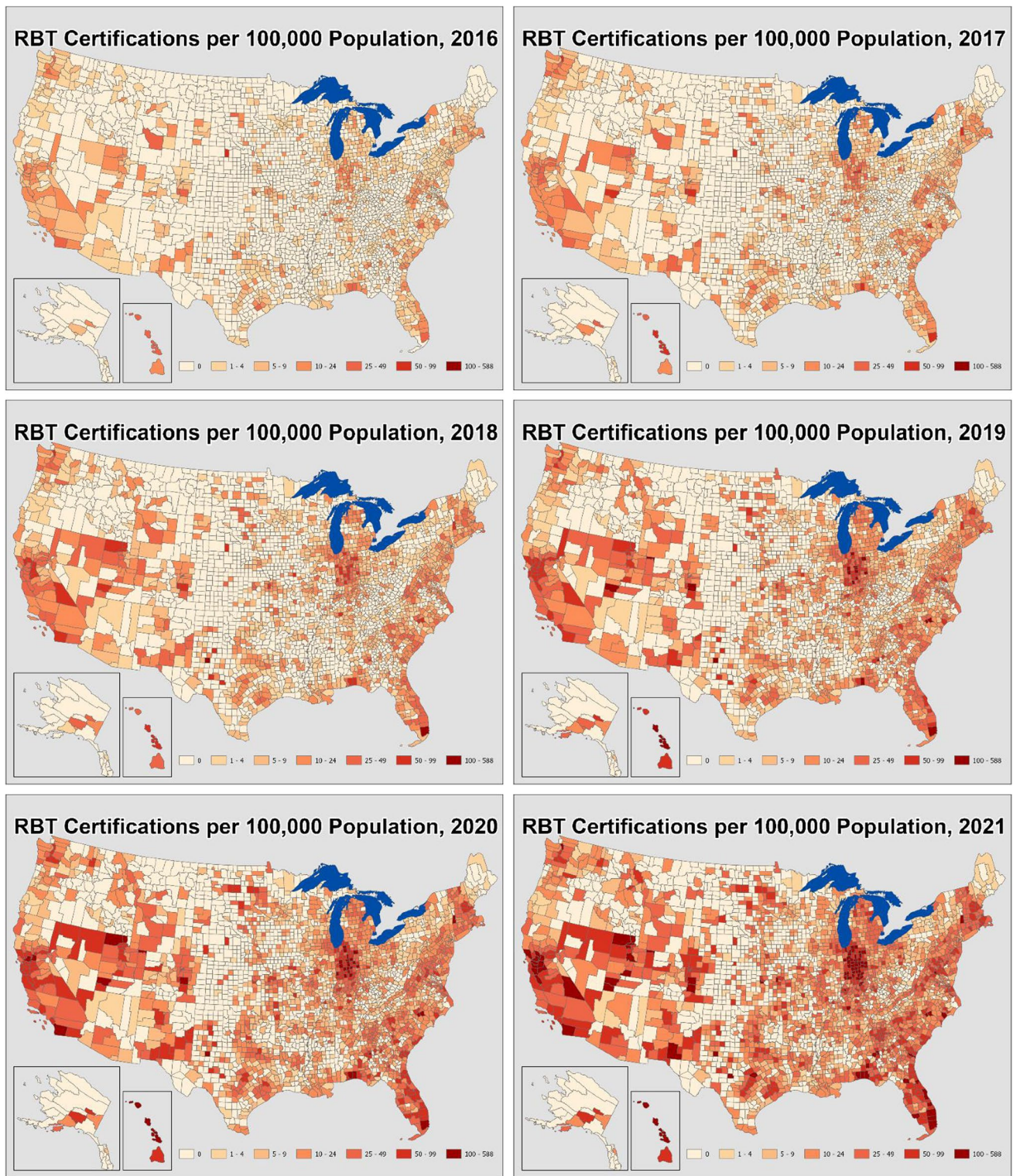


Fig. 1 Trends in registered behavior technician certifications by U.S. County between 2016 and 2021

in these states/areas having low ratios (< 10, on average) of children with ASD per RBT.

Discussion

This study, which is the first to examine the geographic

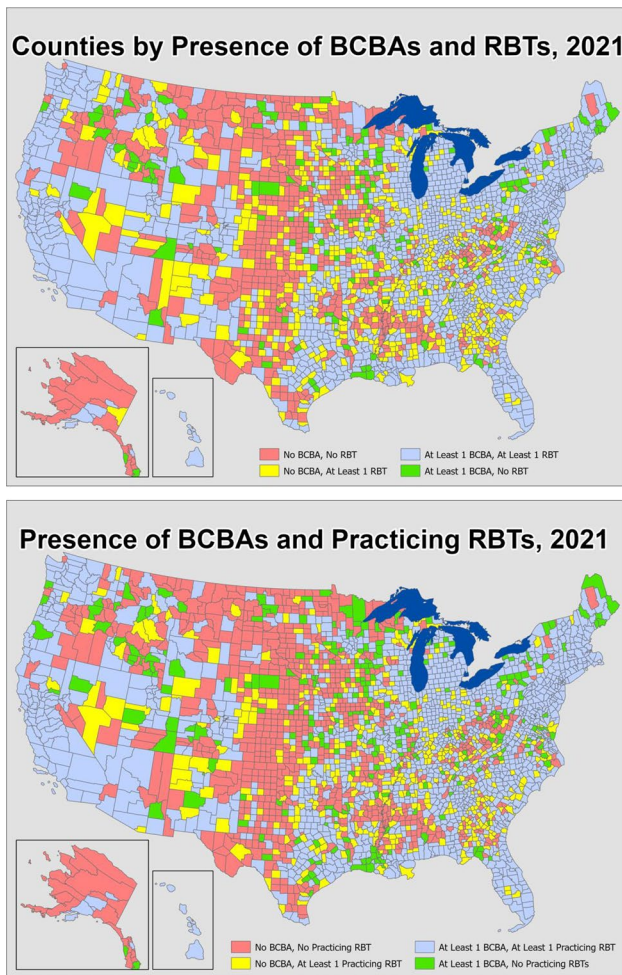


Fig. 2 a-b U.S. Counties by presence of board certified behavior analysts and registered behavior technicians in 2021

distribution of RBTs in the United States, provides several new insights into the accessibility of ABA providers. First, since its creation, the distribution of RBTs has been very uneven across the country. In earlier years, RBT presence was concentrated in the state of Indiana, Northern California, and along much of the Eastern Seaboard. Of course, over time RBT distribution has significantly improved. Although these areas remain hotspots of RBT presence similar to that of BCBA (Yingling et al., 2021b), today there are also large numbers of RBTs in Utah, Colorado, and Hawaii, as well as in scattered counties throughout the Midwest. Still, one-fourth of all counties—which together have 8,281 children with ASD—have no RBTs as well as no BCBA. Of the 10 counties in this group that have the largest number of children with ASD, 6 are in Minnesota (which has very high ASD prevalence rates). These “no-provider” counties stretch from the upper Mountain and Plains states down through Texas, and there are notable concentrations in parts of the Southeast and in the Appalachian region in West

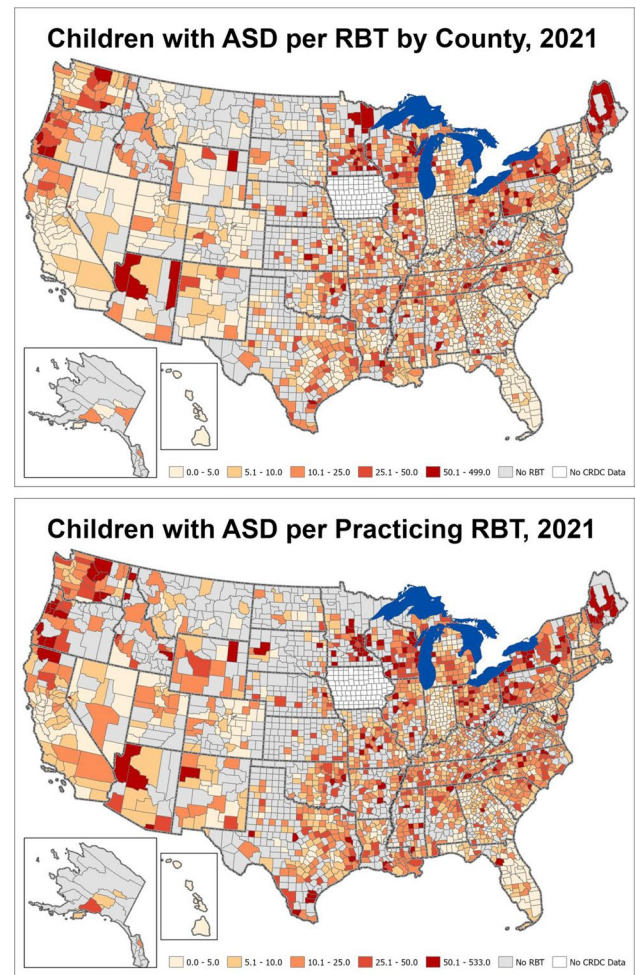


Fig. 3 a-b Prevalence of children with autism spectrum disorder per registered behavior technician by U.S. County in 2021

Virginia and Kentucky. County-level ASD/RBT ratios indicate that even in counties with RBT presence, the number of children with ASD far exceed RBTs, suggesting that there are likely fewer technicians than needed in those counties. Inequities in accessibility are even starker when we remove nonpracticing RBTs from the analysis. More than 8,500 children with ASD reside in counties which have one or more RBTs that are currently unsupervised (and thus not practicing). Although these children would on the surface seem to have providers accessible, this may not actually be the case. This is an important consideration in any policy initiatives to increase RBT accessibility and for future research, which should take these differences into account.

In terms of county presence, the geographic accessibility of RBTs—whether practicing or not—appears to be superior to that of BCBA. At the time of data collection, although 70% of all counties had at least one RBT, a large number of these counties ($n = 623$) had no BCBA. The mode of supervision in these counties—in-person or telehealth—is

not captured in these data. BCBA's in adjacent counties or in a county within reasonable driving distance could be commuting to provide supervision. If BCBA's must travel long distances to meet supervision requirements (BACB, 2022c), then there are fewer hours available in their workday to supervise, possibly resulting in lower caseloads which further limit access to ABA services. If BCBA's provide supervision to fewer clients, then prospective clients could wait longer to begin services and current clients could receive treatment hours based on what a BCBA's schedule can accommodate rather than based on need.

In these cases, telehealth may offer an opportunity to improve access, as the benefits of reduced travel burden and shortened waitlists are well documented (Tomlinson et al., 2018). As an alternative, some BCBA's could already be providing supervision remotely. In cases where commuting is infeasible, the provision of supervision via telehealth may be the only option for meeting the medical needs of children who live in underserved locations (Council of Autism Service Providers, 2021). Indeed, at least at face value, the provision of telehealth services costs substantially less than in-person services (Tomlinson et al., 2018). Another potential barrier to accessing services, however, is meeting supervision requirements via video conference while maintaining compliance with applicable privacy laws (e.g., HIPAA, FERPA) and state licensure regulations. Because it is often difficult to get permission to video tape or even provide live supervision remotely in certain settings (e.g., group therapy, classroom), it is possible that remote supervision is not being provided in underserved locations as frequently as may be necessary (BACB, 2022c).

Although study results highlight the need to improve geographic access to services, research on the effectiveness of telehealth as a service-delivery mechanism for the provision of services is still emerging. Scholars are debating the most appropriate methods for evaluating effectiveness (Ellison et al., 2021; Ferguson et al., 2019; Unholz-Bowden et al., 2020). It is imperative, therefore, that utilization of telehealth be coupled with continuing investigations into quality controls (Baumes et al., 2020; Nohelty et al., 2021; Rodriguez, 2020). The provision of services via telehealth is highly dependent upon health insurance reimbursement (Pollard et al., 2017). As in every other facet of health-care provision, the COVID-19 pandemic thrust providers into remote service delivery (Office for Civil Rights, 2020). To maintain service continuity BCBA's gained wider approval to utilize telehealth during shelter-in-place mandates. It can be argued that this widespread utilization was a crash-course for practitioners of the benefits and shortcomings of telehealth, including technician-delivered services (Pollard et al., 2021). Yet it also exposed the frustration many families of children with ASD who live in underserved areas already experienced

before the pandemic. As the impacts of the COVID-19 pandemic fade, it is important that professional associations and providers remember children and families in underserved areas and ensure that where telehealth can enhance access to quality services, there are funding mechanisms available to support it.

Beyond telehealth, recruitment of quality frontline practitioners is important to ensuring geographic access. For this to occur, ABA service organizations will need to carefully study the reasons employees separate and mitigate turnover by seeking ways to improve training, supervision, pay, and other aspects of the job for front-line staff (Kazemi et al., 2015; Wine et al., 2020). Since its establishment in 2014, more funders are adopting the RBT credential as a standard. However, the credential is not required by all funders. The results of this study, therefore, only shed light on geographic access to RBTs, not all front-line practitioners that may be delivering ABA services under the supervision of a BCBA. This may underestimate the accessibility of ABA services; other front-line practitioners may be present in underserved counties but not captured by the data utilized in this study. It is also worthwhile to note that some organizations will seek RBT credentials for their staff even if it is not required by all of their funders so there is consistency amongst its staff within the organization or because they believe the credential leads to better quality services (regardless of whether it is required or not). In other words, many organizations may adopt the RBT credential for their staff even if none, one, or only some of their funders require it. Also, any BCBA's already commuting to counties outside of their reported location address to provide supervision or those who are doing so via telehealth are not captured in this study.

States only report children's primary educational disability. Therefore, it is possible that some children have a secondary educational disability of ASD and a different primary educational disability, such as intellectual disability. States vary in eligibility requirements for a primary disability of ASD (MacFarlane & Kanaya, 2009). Still, the CRDC provides the best data available to estimate prevalence of ASD. Additional details about the limitations of the CRDC data related to children with ASD have been recorded elsewhere (Yingling et al., 2021b). Furthermore, adults were not included in analyses because no data equivalent to the CRDC exist. By default, however, if adults were included in analyses, it is reasonable to assume that geographic access to RBTs among all people with ASD is less in the United States than results indicate.

Data were unavailable on which treatment models RBTs use, the size of their caseloads, and the number of hours spent providing services. Related to this, the county in which individual RBTs provide services may be different from the county in which they reside, which could lead to higher or lower ASD/RBT ratios. Also unknown are the individual

needs of every child with ASD in the United States and caregiver preferences for ABA services.

This study revealed uneven county-level distribution of RBTs in the United States, illustrated change in distribution since the credential's inception, and established a baseline of county-level geographic access to RBTs among children with ASD. With the ultimate goal of improving access to ABA services, future research that examines the supervision caseloads of BCBA's who are qualified and willing to provide supervision to RBTs would yield a more precise understanding of the accessibility of ABA services. In addition, as the number of RBTs and demand for them continues to increase rapidly (BACB, 2021), future examinations of geographic distribution may be worthwhile.

Acknowledgments MY conceived the study, led its design and coordination, drafted the introduction and discussion, and finalized the manuscript; MR contributed to design and conceptualization, conducted analyses, drafted the methods and results, and provided feedback on manuscript drafts. ED contributed to study design, provided expertise especially in the discussion, and offered feedback on manuscript drafts. All authors read and approved the final manuscript.

Declarations

Conflicts of Interest The authors have no relevant financial or non-financial interests to disclose.

Ethical Approval This research did not include human subjects. Informed consent was not required.

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